Skylight insulation, examples

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This article describes ways to increase the insulation (R-value) of skylights, thereby, reducing winter heat loss and summer heat gain. Double glazed skylights have approximately R 1-2 (U = 0.7 - 1.1) insulation value. The insulation value of skylights is ~50-60% of vertically mounted windows with equivalent construction because warm air rises up to the ceiling where the skylight is located and continues up through the skylight (see Jeffery L. Warner, 1993. Sizing Up Skylight. Lawrence Berkeley Laboratory www.homeenergy.org). Warm air also escapes through the skylight weep holes that drain moisture condensate.

Here are ways to insulate skylights (See Figure 1).

1. The least expensive and simplest method is attaching a window film to the ceiling, blocking warm air from escaping through the weep holes. Additional films can be installed in the light well by attaching tracks around the inside perimeter of the light well. The top track can support a rigid plastic sheet (to catch falling debris if the skylight breaks). Grooves are cut into the track to reduce the possibility of the window film detaching as the film is shrunk to fit (Figure 2). Use a router or table saw to cut a groove in the track. Apply spray adhesive (e.g. 3M Super 77 Spray Adhesive) to the track before attaching adhesive tape to enhance adhesion. Also apply spray adhesive to the wall of light well. Attach window film to the adhesive tape and to side wall of the light well (see Figure 2). "3M" window film is more expensive but has superior light transmission and more durable adhesive tape compared to less expensive window films. Each film adds ~ R-0.5 to the insulation value.
2. Magnetic clear plastic storm window can be attached to the ceiling (see James Dulley. September 2001 Illinois Country Living, Illinois Periodicals Online www.lib.niu.edu/ipo/ic010918).
3. Glass windowpanes or rigid plastic sheets can be added under the skylight. This creates a dead air space between the skylight and the windowpane and between the windowpane and the plastic window film (item 1). This also minimized the amount of window film movement that result from the sudden change in air pressure cause by the opening and closing of doors. Check local building code on the use of glass under the skylight. (For example, laminated, tempered, heat-strengthened or wired glass may be required if the distance from floor to the skylight is less than 12 feet and the glass area is less than 16 square feet. Wire screen may be required under the glass if the distance from floor to skylight is 12 feet or more. Additional restrictions may apply in hurricane and earthquake zones.) Each glazing adds ~ R-0.5 to the insulation value. Each 2 x 4 feet double glazed window adds approximately 20 pounds; 3 sets of double glaze window add 60 pounds and increase the insulation by ~ R-3. The light well must be insulated in the attic, from ceiling to roof; otherwise, heat would escape through the light well to the attic.
4. Hinged foam insulation board that swings open during daytime and closed at night can be attached to the ceiling. A 1-1/2-inch foil faced polyisocyanurate insulation board (e.g.

Atlas Energy Shield) adds R-11 to the insulation value, considerably higher R-value than window film or glass. Alternatively, use polystyrene insulation board. Cover the background ink and color of the insulation board with aluminum foil; attach foil to board with spray adhesive (e.g. 3M Super 77 Spray Adhesive). Protect the aluminum foil with vinyl wall covering. Use 2 x lumber to make a wood trim surrounding the insulation board edge.

Material required for installing a hinged insulation board for a 2 x 4 feet skylight fitted to 24 inch on-center ceiling joist include:

a. Rigid insulation board

b. Wood trims surrounding the edge of the insulation board.

c. Two 3-inch T- hinges, the long strap is bent 90 degrees at 7/8 inch from pivot centerline.

d. Four latches, two to hold the board in the 'close' position, and two latches to hold the board in the 'open' position. Latches must be strong enough to support the weight of the hinged insulation board.

e. Aluminum foil, spray adhesive and vinyl wall covering.

f. Nail and caulk to secure the wood trim to the insulation board.

g. Rubber weather strip to seal the air gap between the insulation board and ceiling.

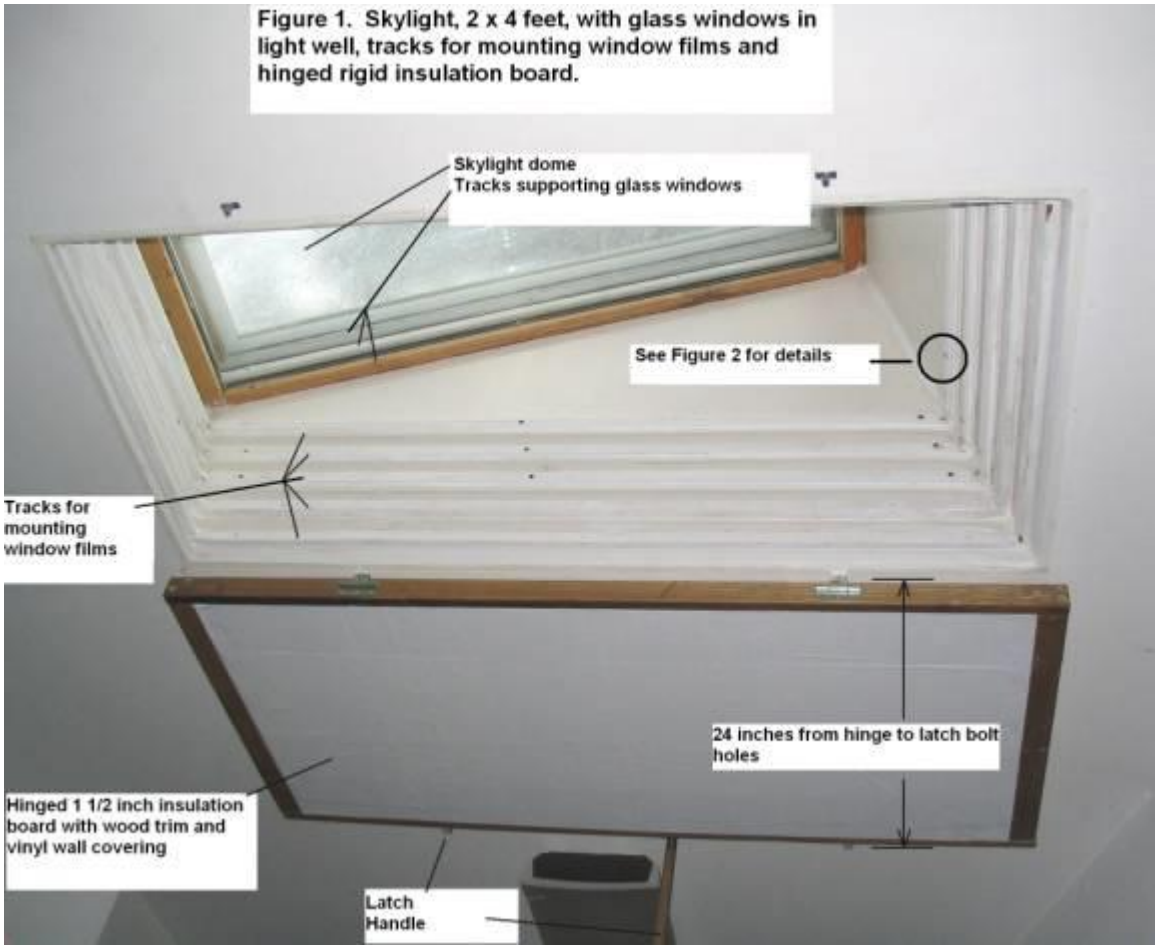
Skylight dome
Tracks supporting glass windows
See Figure 2 for details
Tracks for mounting window films
24 inches from hinge to latch bolt holes
Hinged 1 1/2 inch insulation board with wood trim and vinyl wall covering
Latch Handle

Figure 1. Skylight, 2 x 4 feet, with glass windows in light well, tracks for mounting window films and hinged rigid insulation board.

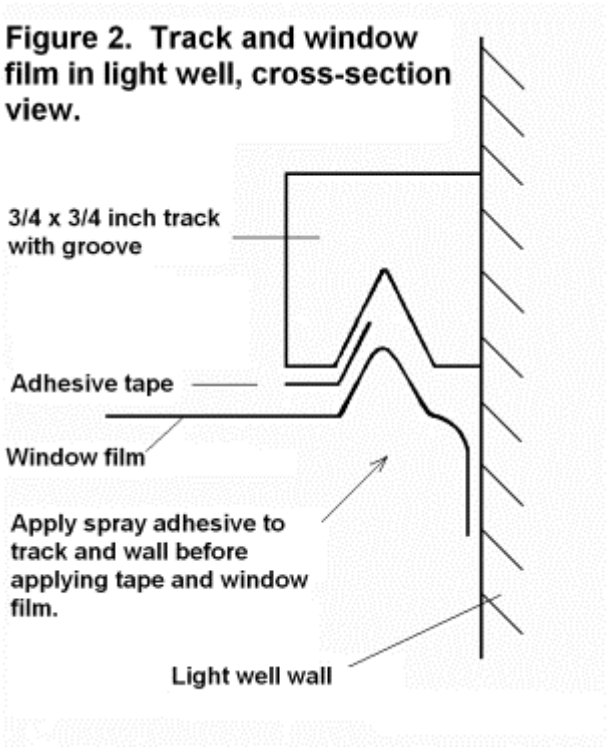
3/4 x 3/4 inch track with groove
Adhesive tape
Window film
Apply spray adhesive to track and wall before applying tape and window film.
Light well wall

Figure 2. Track and window film in light well, cross-section view.

Summary:
1. Window film is low cost, easy to install, easy to replace when dirt accumulates, and increase the insulation value by ~ R-0.5. Window film flexes when the air pressure changes.
2. Glass and rigid plastic does not readily flex when air pressure changes, and increase the insulation value by ~R-0.5 for each glazing.
3. Rigid insulation board significantly increases the insulation value when it is closed (covering the light well), ~ R-11 for 1 1/2 foil faced board. It does not provide insulation when it is open (letting light through).

Note: Mention of product and company names does not imply endorsement.

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